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To cite this article: Katrien Van Poeck (2018): Environmental and sustainability education in a post-truth era. An exploration of epistemology and didactics beyond the objectivism-relativism dualism, Environmental Education Research, DOI: [10.1080/13504622.2018.1496404](https://doi.org/10.1080/13504622.2018.1496404)

To link to this article: <https://doi.org/10.1080/13504622.2018.1496404>



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Published online: 08 Nov 2018.



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Environmental and sustainability education in a post-truth era. An exploration of epistemology and didactics beyond the objectivism-relativism dualism

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ABSTRACT

This article focuses on environmental and sustainability education (ESE) in the context of the topical post-truth debate. It aims to progress theoretical research as well as empirical investigations on how ESE practices can avoid the pitfalls involved in an objectivist as well as a relativist approach to teaching and learning. After elaborating the problems implied in both these approaches, the article explores concepts developed in science and technology studies (STS) that have the potential to inspire ESE research and practice to move beyond this problematic dichotomy: Latour's 'matters of concern' and 'compositionism' and Jasanoff's 'co-production' and 'socio-technical imaginaries'. Drawing on pragmatist educational theory the author develops a conceptual framework that serves as a theoretical model for investigations of how ESE subject matter and teaching methods can be introduced, handled and experienced in a way that moves beyond the dualism of objectivism versus relativism. Building on the work of scholars who have connected Dewey's pragmatic, transactional perspective to the domain of didactical research, it is shown how this theoretical model can be operationalised for empirical studies with the help of well-chosen analytical methods. The article is concluded with some reflections on the limitations and potential of the presented framework.

ARTICLE HISTORY

Received 6 September 2017
Accepted 30 June 2018

KEYWORDS

environmental and sustainability education; science and technology studies; pragmatism; post-truth

Introduction

'Post-truth' has been chosen as the 2016 word of the year by the Oxford Dictionaries. 'How could truth become passé?', Higgins (2016, n.p.) wonders in a column in *Nature*. Scientists, she argues, should be shocked by the idea of post-truth, by the observation of increasing public tolerance of inaccurate, undefended allegations and outright denials of facts, and especially by the lack of public indignation when policymakers claim disbelief in response to scientific consensus on issues such as climate change. 'They should speak up when scientific findings are ... treated as mere matters of faith' and 'must keep reminding society of the importance of the social mission of science — to provide the best information possible as the basis for public policy'. Even if one is, indeed, shocked by seeing how serious interest in issues and intellectual virtues such as critical thinking, sustained inquiry and revision of beliefs on the basis of evidence is 'treated as the idiosyncrasy of wonks' (Higgins 2016, n.p.), one may as well be reluctant of adopting *fact-based*

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politics as the ultimate alternative for the currently reviled ‘*fact-free* politics’. After all, the traditional allocation of tasks between science and politics within which scientists are assumed to provide objective, established facts as a basis for rational decision-making has also been the subject of criticism. Controversies over sustainability issues show that attempts to settle issues by appealing to expert knowledge very often get bogged down in a fierce antagonism between expertise and counter-expertise (Sarewitz 2004; Goeminne 2012). Furthermore, over the last decennia the field of Science and Technology Studies (STS) has created an integrative understanding of the societal origins, dynamics and consequences of science and technology. Viewing science as a socially and culturally situated set of practices contrasts sharply with the positivist conception which draws a clear dividing line between science and society. Notably, STS research has argued that scientific ‘facts’ and ‘truth’ do not enter the social world fully formed; rather they are *produced* in the course of working out political and social arguments (Latour and Woolgar, 1979/1986; Daston and Galison 2007).

The post-truth debate bears resemblance to a long-lasting discussion in the field of Environmental and Sustainability Education (ESE) research. Obviously, finding appropriate ways to deal with ‘truth’ and ‘facts’ is a key pedagogic and didactic challenge in all forms of education. And it is not very surprising that especially when education is faced with environmental and sustainability issues, pressing questions about and struggles with truth and facts emerge. Issues such as climate change, loss of biodiversity, resource depletion, and gentrification often do not fit into the dominant and deeply rooted Western worldview, with its strict division between ‘objective’ facts and truths versus ‘subjective’ values, preferences and beliefs (Latour 2010; Goeminne 2011). They are characterised by an inextricable entanglement of social, political, human aspects on the one hand and material, technical, natural elements on the other. Hence, ESE educators and researchers are challenged by the question what constitutes good teaching in relation to such issues. Many ESE scholars (e.g. Ashley 2000; Öhman 2008; Öhman and Östman 2008; Östman 2010; Sund and Öhman 2014; Garrison et al. 2015; Lysgaard and Fjelsted 2015; Van Poeck and Lysgaard 2016; Van Poeck et al. 2016) have pointed out risks involved in what we could see as the pedagogical equivalent for the above problematized dichotomy of ‘fact-based’ and ‘fact-free’ politics, that is, either an objectivist or a relativist approach to teaching and learning in the face of environmental and sustainability issues. The former sees the factual account of the state of the planet as a non-negotiable basis for normative guidelines on how to think and act that should be transmitted through teaching and learning. The latter, on the other hand, is grounded in an understanding of pluralism as a sheer fact of plurality, resulting in an anything-goes spirit that grants every opinion equal value. Highlighting the problems involved in both extremes these scholars argue for theoretical, methodological as well as didactical frameworks that move beyond the relativism versus objectivism dichotomy. A major challenge for ESE, then, is to organise and select subject matter and teaching methods that enable to simultaneously take into account nonhuman objects, science, nature, materiality, etc. on the one hand, and human subjects, society, politics, ethics, discourse etc. on the other. Not as two separated and mutually exclusive spheres – which would leave us with nothing but the choice between objectivism or relativism – but as intimately entangled and inextricable dimensions.

This article aims to progress ESE scholarship in this respect. Its main ambition is to foster theoretical research as well as empirical investigations in how ESE practices can avoid the pitfalls involved in an objectivist as well as a relativist approach. Therefore, I develop a conceptual framework that should enable ESE researchers to examine teaching and learning in ESE practices as to whether – and, if so, how – the inextricable entanglement of social, political, human aspects on the one hand and material, technical, natural elements on the other is reflected in the content (subject matter) and process (teaching methods) of ESE. In the remainder of the article, I will first further elaborate the problems implied in approaches to ESE that are grounded in the objectivism versus relativism dualism. Then, I explore and describe concepts developed by STS scholars Bruno Latour and Sheila Jasanoff that have the potential to inspire ESE research and

practice to move beyond this problematic dichotomy. Next, I engage with the challenging question how these theoretical, epistemological perspectives can be translated into the domain of didactics. Drawing on pragmatist educational theory I develop a conceptual framework that serves as a theoretical model for investigations of how ESE subject matter and teaching methods can be introduced, handled and experienced in a way that moves beyond the dualism of objectivism versus relativism. Building on the work of scholars who have connected John Dewey's pragmatic, transactional perspective to the domain of didactical research, I show how this theoretical model can be operationalised for empirical studies with the help of well-chosen analytical methods. I conclude the article with some reflections on the implications, limitations and potential of the presented framework.

ESE: Caught in a dualist worldview?

As argued, ESE educators face the challenging question how to deal with truth, facts, values, preferences and beliefs in their education practice. Distinguishing between three 'selective traditions' in ESE, Öhman (2008) and Sandell et al. (2005) interestingly capture how different answers to this question have resulted in very different education practices in terms of the selection and organisation of the subject matter as well as the selection of teaching methods. First, the *fact-based tradition* builds on the assumption that only science can provide a reliable foundation for our knowledge about environmental and sustainability issues and that scientific facts and models have sole importance as to guiding teaching and learning. Hence, the issues at stake are primarily treated as knowledge problems. If students acquire the proper factual knowledge about environmental and sustainability issues, it is assumed, they will automatically become competent in dealing with them. The main objection raised against this approach, is the omission of the value dimension of sustainable development. As a response to this shortcoming, a second, *normative tradition* emerged. Here, the main task of education is considered to be its contribution to the value-laden ambition to create a more sustainable society: teaching students sustainability-oriented values and attitudes in order to change their behaviour in the desired direction. Discussions among experts and politicians on the basis of scientific facts about the current state of the world are assumed to deliver universal solutions to environmental and developmental problems which are then supposed to be disseminated through curricula and syllabuses. Also this normative approach has been criticised. A major objection raised is that environmental and sustainability issues involve conflicts between different values, ideologies, priorities and strategies which cannot be dissolved by simply referring to science as a universal and neutral foundation which provides answers to questions about how people should live their lives and develop society. 'Although there might be agreement on certain facts, the judgements of these facts and the way of valuing the consequences of different measures may differ as a consequence of personal or contextual aspects', Öhman (2008, 20) argues. Furthermore, a normative approach is criticised for threatening education's emancipatory potential and its democratic obligation. Turning education into a political tool to create a specific predetermined society, it is argued, reduces it to mere indoctrination. The third, *pluralistic tradition*, in contrast, emphasises the democratic mission of education claiming that involving diverse interest groups, supporting free opinion-making and enhancing students' competence to act in a conscious way and to participate in debates, discussions and decisions should be the main goals of ESE. This approach focuses on promoting different perspectives, views and values when dealing with various questions and problems concerning the future of our world. Deliberative discussions are considered to be an essential part of pluralistic ESE and should result in finding common answers to value-related issues, or recognising and accepting different standpoints. An often mentioned objection against a pluralistic approach is the risk of falling into anything goes relativism. Striving to illuminate different opinions could be interpreted as all alternative actions being equally right and

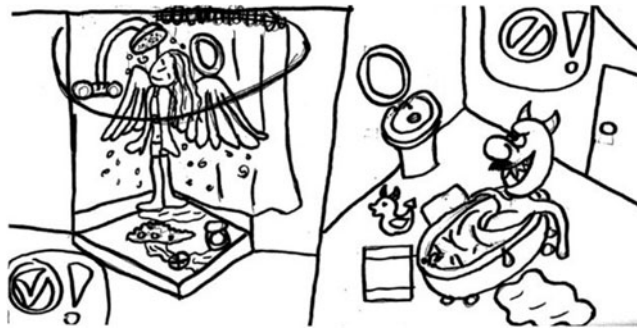


Figure 1. Drawing Ecological Footprint Booklet.

all values equally good. This critique, however, is only valid within a dualistic perspective as it is 'intimately associated with a traditional realist philosophical framework and the presumption that we are stuck with two incommensurable options concerning our attitudes to the right and the good, namely objectivism – that it is possible to anchor moral beliefs in an external and eternal foundation, or relativism – that no such foundations exist and that all opinions about the right and the good are merely arbitrary constructions relative to a specific paradigm, theoretical framework, culture or form of life' (Öhman 2008, 21).

Before moving on to a critique of this dichotomist worldview, I want to illustrate its strong influence on ESE practice with a concrete example stemming from a case study of an environmental education project for schools in Belgium (see also Van Poeck 2013). In this case study, two very different ways of approaching the ecological footprint as subject matter were identified. First, a primary school developed an 'Ecological Footprint Booklet' aiming to raise awareness among students and their parents about our ecological impact. The booklet was created by teachers and students and consisted of behaviour precepts and drawings. The teachers selected behaviour guidelines to reduce one's ecological footprint (e.g. taking a shower instead of a bath) and the pupils provided each precept with a matching drawing (see Figure 1).

This is an example of an objectivist approach built on the assumption that we can anchor moral beliefs and normative behavioural do's and don'ts in an external and eternal foundation, i.e. a factual, well measurable account of our ecological impact and effective ways to reduce it. As the drawing interestingly reveals, the students and their teachers were obviously convinced of which kind of behaviour is desirable (see: '✓!') and which should be avoided (see: '⊗!'). The staging of an angel versus a devil as key figures reflects the morally normative stand. The ecological footprint, here, emerges as an objective matter of fact that can – and should – guide subjective, individual and societal choices and decisions.

In a second, secondary school a religion teacher used the subject of unequally distributed ecological footprints to address and discuss the issues of social justice and solidarity in relation to sustainability. After watching a documentary about '*the Low Impact Man*' who tried to obtain a lifestyle within sustainable ecological limits by complying with drastic behaviour precepts (no meat, no car, raw food, no travelling, taking showers with cold rain water, etc.) the students discussed the question whether or not they would be willing to live within the limits of a global average fair share of 1,8 ha. The outcome of this open-ended deliberation was that the students decided that they would prefer not to. And that was the end of the matter. No further discussion about the implications of this preference. Hence, the ecological footprint emerges as a matter of individual values and choices, i.e. as an arbitrary construction without any foundations resulting in a relativistic tolerance rendering any opinion or preference equally valid.

Both approaches, I will argue, are each in their own way problematic as the underlying dualistic worldview that is dominant in our modern Western society and that sharply separates facts from values, materiality from discourse, nature from society, epistemology from ethics and

aesthetics, objectivity from subjectivity, science from politics, etc. contravenes the ontology of sustainability issues that are constituted by an inextricably entanglement of all these dimensions. In the next section, I underpin this argument with critiques raised on the dichotomist perspective implied in this worldview.

Objectivism versus relativism: Four critiques

Since the Enlightenment, the Cartesian duality that installed a separation of human consciousness from nature increasingly affected our modern world which divided itself into the distinct value spheres of epistemology (reason, science, technology, etc.), ethics (morality, justice, religion, etc.) and aesthetics (artistic creation, aesthetic criticism, beauty, etc.) (Garrison et al. 2015). This 'Modernist Constitution', as Latour (2010) calls such a dualistic worldview, has been criticised for several reasons.

First, it is at odds with what happens in *practice*. The Modernist Constitution denies to a large extent the 'social embeddedness of scientific practice' and the situated and human character of the genesis of scientific knowledge (Goeminne 2012, 151; see also e.g. Jasanoff 2004; Latour 2005) at the same time as it fails to seriously acknowledge the impact of materiality and technoscientific artefacts on human behaviour, social life, political decision-making, etc. (e.g. Latour 1988; Marres 2010, 2011; Goeminne and François 2010). Drawing on a historical and constructivist analysis of climate science *in the making*, Goeminne (2012) illustrates how the current practice of climate modelling and the prevailing scientific construction of the climate is a contingent social outcome of a dynamic interplay between problem framing and solution framing driven by concerns such as globalism, simulation and prediction. This, he emphasises, is not the only possible, unique answer to an unequivocal question.

Second, a dualistic worldview inevitably brings about a very *partial* view of reality bounded and distorted by either 'naïve realism' or 'absolute idealism' (Lysgaard and Fjelsted 2015). Constructing a two-tiered world of, on the one hand, 'matters of fact' that 'speak by themselves' and are beyond dispute, and, on the other, disputable human assertions, opinions and preferences, i.e. 'matters of value' (Latour 2004a) drastically reduces the epistemological space. The only positions left, then, are either an objectivist or a relativist perspective (Latour 2010). Yet, highly complex, uncertain, contested, historically situated, far reaching ... issues such as sustainability problems never occupy one of these two positions (Latour 2004a). We face a proliferation of states of affairs that neither fit in the list of 'mere' values, opinions, preferences, etc. nor in the list of undisputable facts. Thinking from within the Modernist Constitution only allows oscillating between the separated worlds of facts and values in an attempt to mend what got artificially divided but what, in reality, never got broken in the first place. Ironically, Garrison et al. (2015) argue, attempts to counteract objectivism – in which values, opinions, preferences, interests, passions ... are subordinated to matters of fact – by prioritising ethical and aesthetical values over epistemological ones merely invert the hierarchy of separated values spheres, thereby *accepting* the initially constructed separations. Hence, it is vital to create perspectives where facts and values can emerge in their interconnectedness.

A third point of criticism is that this dualistic worldview neutralises the *political* dimension of the issues addressed by removing from view the struggles over inclusion and exclusion (Mouffe 2005), i.e. over what to take into account, what to care about, and who is allowed to decide on that. The distinction between, on the one hand, undisputable facts which some enlightened people have unmediated access to and on the other hand disputable human assertions, opinions and values (Latour 2010; Decuyper et al. 2011) neutralises the political space. Science is assumed to inform political decision making with judgements that are beyond question. Truth is understood in a one-dimensional way: there exists only one truth, 'logical truth' (Boehm 2002), which is exclusively graspable by means of the sciences (Goeminne and François 2010) and results in objective, neutral, a-political matters of fact. This paralyses political struggles in the

sense that it does not allow contesting and discussing alternative visions of society (Goeminne 2011). What is removed from view, ironically, is the very *political* character of this epistemology (Latour 2010), i.e. that science composes its issues in a non-neutral way. Every construction, including a scientific one, divides and separates, includes some concerns while excluding others. Acknowledging that a problem is never 'given' (as a matter of fact) or 'chosen' (as a matter of preferences, interests or values) but instead 'concernfully formulated, framed, given shape' (Goeminne and François 2010, 118) opens-up a political space for discussions over 'topical truth' (Boehm 2002), that is, over the question 'what issue is at stake?' and which concerns, values, facts, etc. should be taken into account.

'(W)hereas logical truth is a measure of the answers of science in terms of the correspondence between matters of fact and a reality out there, topical truth can be thought of as a measure of the questions of science in terms of the relevance and adequacy with regard to what is considered to be the matter of concern' (Goeminne 2011, 632).

Finally, the boundaries of the Modernist Constitution limit the space for *newness and creativity*. This is particularly problematic since urgent and far-reaching sustainability issues – too persistent to tackle with routine ways of problem-solving – demand new ways of thinking and doing. Yet, in a dualist world of facts and values critique prevails over creativity. Moreover, as Latour (2004a) argues, the kind of critique that is possible within this reductionist and distorted epistemological space is not likely to provide creative solutions for sustainability issues. Both factual disputes over logical truth and endless deconstruction and debunking (Goeminne and François 2010) of opinions, values, concerns, etc. bring disputes over vital matters of concern to a deadlock. The problem with the former is that it denies the social embeddedness of matters of fact and, thereby, the legitimacy of a struggle over topical truth. The latter, in turn, risks to fall into undue anything-goes relativism by rendering the lack of scientific certainty – 'inherent in the construction of facts' (Latour 2004a, 227) – into a foundation for uncompromising deconstruction that bears strong resemblances with artificially maintained controversies such as climate change denial (Latour, *ibid.*). Hence, as Garrison et al. (2015, 184-185) argue, 'we must be not only critical, but also creative' as mere criticism makes it impossible to perceive dramatically different possibilities. They introduce the notion of 'educative moment' to refer to situations where creative possibilities for the future open up as a result of 'critical and creative inquiry'. As Dewey (1934) explains, 'imaginative experiences' of possibilities open-up a space for not only criticism but also creativity:

'A sense of possibilities that are unrealized and that might be realized are when they are put in contrast with actual conditions, the most penetrating "criticism" of the latter that can be made. It is by a sense of possibilities opening up before us that we become aware of constrictions that hem us in and of the burdens that oppress.' (Dewey 1934)

These four critiques are helpful to return to the ESE examples on the ecological footprint and to further specify why both an objectivist and a relativist approach to teaching and learning are problematic. By framing the ecological footprint either as a matter of fact or as a matter of value, the students are offered a very partial, distorted view of reality in which the entanglement of facts and values, knowledge and preferences, etc. is removed from view. At the same time, this closes the door for a political perspective on the distribution of ecological footprints. The questions what is actually at stake and which/whose concerns should be included or excluded are either foreclosed by predetermined answers based on matters of fact or rendered irrelevant in an anything-goes spirit. Furthermore, the examples also fail to take seriously what happens in concrete practices: First, the practice of calculating and measuring footprints of individuals, groups, activities, etc. as a very situated, socially embedded and human practice¹ and, second, the way in which people actually make choices by carefully weighing a complex of factors in which facts and values are intimately entangled². Finally, both examples leave little room for creativity. The only options the primary school pupils seem to have, is either to comply with or to violate the behaviour guidelines in the booklet, not to explore and confront radically different

options. Also the relativist approach hinders critical and creative inquiry of what it means and implies to adopt one's lifestyle to the planet's ecological limits – or to decide not to.

Although helpful for a better understanding of the problems involved in a dichotomist perspective that reduces ESE to either objectivist or relativist approaches, these four critiques are as such insufficient to analyse or criticise concrete ESE practices. Obviously, my discussion of the two examples cannot be seen as a thorough empirical analysis. Instead, the cases rather serve as illustrations of an ideal typical objectivist and relativist approach that allow to highlight and discuss the problems involved at a very general level. A detailed and critical analysis of what actually happens in concrete practices, which meaning-making of reality is created by it, whether and how this opens-up a space for creativity and for the political, etc. demands sophisticated empirical research. Beyond ontological and epistemological critiques like the ones elaborated above, this requires a sound and well-suited analytical framework. As argued, this article aims to contribute to this. First, by developing a conceptual framework that serves as a theoretical model for investigations of whether and how ESE teaching and learning can move beyond the dichotomy of objectivism versus relativism. Next, by showing how this theoretical model can be operationalised for empirical studies of ESE didactics by connecting it to earlier developed analytical methods inspired by Dewey's pragmatic, transactional perspective.

Exploring non-dualistic epistemological concepts

Work done in the field of STS has provided us with theoretical, epistemological concepts that are not trapped in the dualism of objectivism versus relativism. In the following paragraphs I describe some concepts elaborated by Bruno Latour and Sheila Jasanoff which, I believe, can inspire investigations of how ESE practices handle the above elaborated issues.

Compositionism and matters of concern

As already indicated, Bruno Latour criticises the Modernist Constitution and its divide between, on the one hand, matters of fact that are assumed to be naturally given and objectively knowable and, on the other, human values, preferences, opinions and assertions that are considered mere subjective, social constructions. By introducing the concept of 'compositionism' – in his attempt to write a 'Compositionist Manifesto' – he aims to 'draw attention away from the irrelevant difference between what is constructed and what is not constructed, toward the crucial difference between what is *well* or *badly* constructed, *well* or *badly* composed' (Latour 2010, 3). The term 'composition', with its origin in the Latin word 'componere', reflects that things have to be put together while retaining their heterogeneity. In line with this, Latour (2004a) elaborates on the notion 'matters of concern'. Reality, he argues, cannot be defined by matters of fact. Scientific matters of fact are always also matters of concern, that is to say, compositions made up of complex interdependencies between nature and society, between the material and the social. 'Facts' never enter the social world fully formed but are produced, composed (Latour and Woolgar 1979/1986). From this constructivist perspective, Latour (2010) draws attention to the fact that a composition can also fail, and that what is to be composed may also be *decomposed*. Compositionism is thus as far from relativism as it is from universalism. From the latter, it takes up the task of building a common world, of searching for universality yet without assuming that this universality is already there, waiting to be unveiled and discovered. Hence, from relativism it takes up 'the certainty that this common world has to be built – i.e. composed, constructed – from utterly heterogeneous parts that will never make a whole, but at best a fragile, revisable and diverse composite material' (Latour 2010, 4).

A compositionist stand, Latour (2004a, 2010) argues, also implies a rethinking of what it means to be critical. Instead of criticising matters of fact by deconstructing and debunking, that is, by moving away from them and direct one's attention toward the conditions that made them

possible, compositionist criticism does not aim to get away from facts but, on the contrary, closer to them. Criticism, then, is no longer about fighting empiricism but about renewing it by creating possibilities to bring into attention, explore, and confront a multiplicity of facts, values, assertions, preferences, commitments, attachments (Marres 2005), etc. in their interconnectedness. Doing so opens-up a space for discussions over what Boehm (2002) has called 'topical truth' (see above), that is, over which questions and concerns matter and which ones should take precedence over the others. This specific form of empiricism, Latour (2004a, 231) explains, is a return to a 'stubbornly realist attitude' dealing no longer with matters of fact but with matters of concern. Rather than to debunk, this critical urge requires to protect and to care. It is about *adding* reality to matters of fact instead of subtracting reality and, as such, reflects a difference between deconstruction and constructivism.

'The critic is not the one who debunks, but the one who assembles. The critic is not the one who lifts the rugs from under the feet of the naïve believers, but the one who offers the participants arenas in which to gather.' (Latour 2004a, 246)

Co-production and socio-technical imaginaries

A central aim of STS has been to reveal how the design and development of technological objects are in constant interplay with the social arrangements that inspire and sustain their production³ (Jasanoff 2015). Human choices and user preferences consciously or unconsciously mark the design of objects as well as the kinds of behaviour, benefits and risks they seek to encourage, exclude or regulate. However, Sheila Jasanoff (2015) emphasises, science and technology do not unidirectionally shape our values, norms and social order. In a very symmetrical way, our sense of how we ought to govern and organise ourselves simultaneously and profoundly affects what we make of nature, society and 'the real world'. The concept of 'co-production' explicitly foregrounds this two-way dynamic.

'Briefly stated, co-production is shorthand for the proposition that the ways in which we know and represent the world (both nature and society) are inseparable from the ways in which we choose to live in it. (...) Scientific knowledge, in particular, is not a transcendent mirror of reality. It both embeds and is embedded in social practices, identities, norms, conventions, discourses, instruments and institutions – in short, in all the building blocks of what we term the social. The same can be said even more forcefully of technology.' (Jasanoff 2004, 2-3)

From such a co-productionist perspective, Jasanoff (2015, 4) introduces the interesting analytic concept of 'socio-technical imaginaries' (STI): 'collectively held, institutionally stabilized, and publicly performed visions of desirable futures, animated by shared understandings of forms of social life and social order attainable through, and supportive of, advances in science and technology'. Theoretically, STI occupy a blank space between social theory that has conceptualised imagination as an intersubjective practice and paid attention to how societies construct common narratives, and STS that opened a space for the material aspects of order by highlighting science and technology as key sites for the constitution of social imaginaries. As a co-productionist concept, STI also bridges the epistemic and the normative, the objective and the subjective. The construction of STI blurs the lines between real and imagined realities by 'producing authoritative representations of how the world works – as well as how it should work' (Jasanoff 2015, 6). As an analytic concept, STI allows to address this normative dimension, e.g. through the interplay between utopia, positive imaginations of desired or desirable futures and the obverse: negative dystopia, shared fears of harms related to socio-technical inventions or innovations. It also opens up a space for addressing the political dimension of the issues at stake, i.e. the processes of inclusion and exclusion of imaginations, desires, fears, hopes, etc. As Jasanoff (2015) emphasises, multiple imaginaries co-exist in a society, be it in tension with each other or in a productive, dialectic relationship. Being attentive to that allows exploring the struggle over the power to elevate some imagined futures above others. Moreover, the concept enables us to connect the

production of power and of social and political order with the creativity and innovation in science and technology. In this respect, Jasanoff (2015, 13) refers to Michel Foucault's work to elaborate on 'the constructedness of seeing'. While the viewer constructs what s/he sees, all the same his/her capacity for observation is socially trained in ways that delimit perception. Historical conditioning and the choices and exclusions inherent in it affect what can be seen and what passes unnoticed. Whereas the socially conditioned eye can easily take for granted particular orders of things as rightful⁴, exploring a diversity of STI may open-up possibilities for other ways of seeing and reasoning to enter anyone's imagination when science and technology interact with individual self-awareness and the sense of being well-ruled. This may give rise to forms of disorder, to organised criticism or opposition, to changes in expectations, and to the creation of new collectives through technological as well as social means.

An alternative for objectivist and relativist epistemologies

The reason for selecting these STS concepts as key building blocks for the conceptual framework (see below) is their strong potential to inspire alternatives to the dualist worldview that is dominant in the Modernist Constitution. As I will further elaborate below, connecting these epistemological concepts to didactic research frameworks is very promising in view of progressing investigations and insight in how ESE can overcome the problems of both objectivist and relativist approaches to teaching and learning. Latour and Jasanoff offer us some interesting conceptual pathways to overcome the pitfalls addressed in the four above elaborated critiques. Latour's attention for how facts, truth and, hence, our common world are composed, i.e. constructed as well as Jasanoff's emphasis on how mutually embedded scientific knowledge, technological objects and social orders are co-produced through a multiplicity of interventions, are ways to explicitly and consciously *acknowledge what happens in practices*. STS scholars' efforts to conceptualise and document the social embeddedness of the making of science is very helpful to avoid or counteract undue segregations of scientific, ethical, aesthetical and political practice. In line with this, their consistent resistance to dichotomies such as facts-values, science-politics, nature-society, object-subject, etc. allows to *avoid all too partial, reductionist views of reality* distorted by either naïve realism or idealism. Instead, they make us attentive to how the inextricable entanglement of factual knowledge claims, personal preferences, tangible effects of sustainability problems, dreams for the future, scientific insights, ethical considerations, passions, regulations, etc. that constitute sustainability issues dissolve the artificial boundaries of such a dualist worldview. Both scholars also offer ways of thinking and seeing that allow to *engage with the political dimension of the issues addressed*. As mentioned, Latour characterises (scientific) constructions and compositions as an utmost political practice. Jasanoff, too, addresses the normative dimension of (un)desired futures, processes of prioritisation, inclusion and inclusion and associated struggles over power. The concept of STI, finally, with its the ambition of opening-up possibilities for other ways of seeing and reasoning and fostering changes, leaves *room for creativity*. Although it is important not to overlook how STI contribute to the stability, durability, and coherence of social arrangements⁵, I introduce the concept here with a focus on the creative potential that it also entails. As Jasanoff (2015) argues: 'It offers unfettered entry into the co-produced realities of the known, the made, the remembered, and the desired worlds in which we live, and which we have power to refashion through our creative, collective imaginings.'

From epistemology to didactics: An STS inspired pragmatic framework for in situ analysis of ESE practices

I will now proceed to the central challenge taken up in this article: translating these epistemologically oriented STS concepts into the domain of didactics⁶ in view of developing a conceptual

framework that allows to investigate whether and how objectivist and relativist approaches to ESE subject matter and teaching take shape in educational practice. Despite their great potential to inspire such investigations, the STS concepts *as such* cannot be directly applied to analyse *educational* practices. To make this possible, some translation work is needed to connect STS scholarship to research on teaching and learning. In the remainder of this article I will engage in this ambition by looking for fruitful cross-fertilisation with work done in educational scholarship. After all, also educational scholars have elaborately addressed problems related to the objectivism versus relativism dualism. Pragmatist educational theory, for instance, is built on the anti-dualist philosophical tradition of pragmatism which makes it well-suited for the purpose of this paper. Moreover, educational researchers have built on it to develop analytical methods for empirical investigations of teaching and learning practices. Hence, I will first situate the focus of this article on the topical post-truth debate, the problems of a dualist worldview and its implications for ESE within the established tradition of philosophical pragmatism. Then, I connect Dewey's pragmatic perspective on education to Latour's and Jasanoff's concepts in an attempt to compose a useful conceptual framework for much-needed empirical research. Finally, I show how this framework, that serves as a theoretical model, can be operationalised for didactical empirical research with the help of earlier developed sophisticated analytical methods inspired by Dewey's pragmatic, transactional perspective.

A pragmatist approach

Although it arose over 100 years before the current post-truth discussion and stems from 'a time when positivism still dominated important American philosophy' (Marres 2005, 37) pragmatist theory is utmost relevant and useful to progress thinking about truth, facts and values, relativism and objectivism, etc. in relation to sustainability issues and education. As will become clear in the remainder of this paragraph, Latour's⁷ constructivism (or 'compositionism') and Jasanoff's co-production show strong resemblance to the longer established tradition of philosophical pragmatism. Central in pragmatist theory is a *practical* perspective on truth and knowledge. Pragmatism holds a non-essentialist perspective on truth, defining it in terms of usefulness and acceptance (James 1907). Truth is never absolute – as a stable epistemological equilibrium or destiny characterised by coherence of ideas with an objective reality – but, rather, consists of 'temporary resting-places constructed for specific utilitarian ends' (Rorty 1982, xli). What matters in this practical understanding of epistemology 'is not the question whether it produces exact images of nature as it is, but rather whether its methods and results have consequences that help us to better accomplish our purposes in line with our values' (Östman and Wickman 2014, 367). Thus, according to William James, we construct truth in the process of successful living in the world (James 1975, 97), by asking questions such as: 'What concrete difference will its being true make in anyone's actual life? How will the truth be realized? What experiences will be different from those which would obtain if the belief were false? What, in short, is the truth's cash-value in experiential terms?'. Hence, and similar to the compositionist and co-productionist perspectives elaborated above, pragmatism views truth and knowledge as constructed. In their ground-breaking work *'Knowing and the Known'* John Dewey and Arthur Bentley (1949) interestingly refer to the Latin root of 'fact': 'factum', which means 'something done or made' (Ryan 2011, 51). Analogous with how Latour describes matters of fact as always also matters of concern and to Jasanoff's co-productionist perspective, Dewey and Bentley understand what is known as fact is 'inseparable from how we determine it to be so' (Ibid., 51). This reflects their anti-dualist philosophy centred around the concept of 'transaction'. Instead of starting from separate subjective minds and real external objects, the transactional perspective sees 'mind and object as joint contributors to problem-solving activity' (Ibid., 36). Thus, transactional pragmatism 'sees together' what other philosophies such as rationalism or empiricism 'see apart': mind and matter, subject

and object, self and world. Whereas an *interactional* perspective looks at a phenomenon or event as the sum of its constitutive parts – tracing interactions between *things* that are allocated to the objective natural world and *thoughts* that are situated in subjective experiences – the *transactional* view sees these parts as determined by the whole. Experience, then, already includes ‘the natural realm of encountered things’ (Ibid., 45). Knowing and the known emerge as fully mutually interdependent: ‘*Knowing* as the constructive resolution of problems is integral to anything *known*’ (Ibid., 41). What anything is, cannot be separated from how we come to know and work with it. In Jasanoff’s terms, we could say that it is co-produced. Highlighting the central role of experience in their transactional perspective on knowledge and reality, Dewey and Bentley (1949) can be seen as the precursors of Latour in his attempt to formulate an alternative to traditional empiricism and realism (see above). Their ‘radical empiricism’ is based on remaining true to things as they are actually experienced; and this is never in a dualist way of either ‘all-mind’ or ‘all-matter’ (Ryan 2011, 41). Rather, Dewey’s ‘postulate of immediate experience’ – ‘What *is* is what *is* experiences *as*’ (Ibid., 24) – draws on Peirce’s and James’ pioneering work on how a non-reflective unity of subject and object constitute our everyday habits. First when these are disrupted through unexpected problems that stick and require cognitive inquiry and reflection, our non-reflective default mode of experience is challenged – and restored once a solution is achieved.

A transactional perspective on education

The principle of transaction and the focus on experience are also central in Dewey’s understanding of education (see e.g. Dewey 1916; 1934; 1938). Although it was first through his collaboration with Bentley that Dewey consistently used ‘transaction’ as a central notion in his writings, the transactional perspective can – in retrospect – already be recognised in his earlier writings on education. When writing ‘*Knowing and the Known*’, Dewey and Bentley (1949) hoped ‘to rectify misconceptions about Dewey’s worldview caused by his careless use of *interactional* language in previous writings’ (Ryan 2011, 4). Indeed, in ‘*Experience and Education*’, Dewey (1938) elaborates his theory of experience that is underpinned by the principles of ‘continuity’ and ‘interaction’. The latter, however, should not be understood in a causal, linear and mechanistic way. When arguing that ‘an experience is always what it is because of a *transaction* taking place between an individual and what, at the time, constitutes his environment’ Dewey (1938, 43 – emphasis added) perceives people and their surroundings as mutually interdependent: They transform continuously and reciprocally, i.e. ‘in transaction’. Human actions change the environment and shifts of activity happen in response to changing conditions (Öhman and Östman 2007, Östman and Öhman 2010). Learning can then be described in terms of action, i.e. ‘as meaning making resulting in a more developed and specific repertoire for coordinating activities and the environment’ (Östman and Öhman 2010, 5). This takes place through a continuous process of doing and undergoing the consequences of acts. This is what Dewey (1938, 35) calls the principle of continuity: ‘every experience enacted and undergone modifies the one who acts and undergoes, while this modification affects, whether we wish it or not, the quality of subsequent experiences. For it is a somewhat different person who enters into them. ... every experience both takes up something from those which have gone before and modifies in some way the quality of those which come after.’ Education is thus understood as a process that takes place through encounters between a person and an environment.

The environment is in this transactional perspective understood broadly and encompasses both the social and physical surroundings. It can consist of persons with whom one is talking, the subject talked about, a book one is reading, materials used, imaginations, etc. The knowledge, meanings, etc. emerging from these encounters are not seen as static cognitive properties that can be achieved but as something that is dynamically made and transformed in and by

action. Here, it should be stressed that this transactional perspective on education is not deterministic. Only some aspects of the (social and physical) surrounding conditions become actualised in action and thereby become part of an experience, i.e. become 'an environment'. Thus, people are not determined by their surroundings but also actively (re)constructs them through this process of 'environing'. Analysing how this process takes shape in concrete teaching and learning practices is a way to gain insight in *how* knowledge and meaning are constructed. With the help of well-suited conceptual and analytical tools (see below) this should allow us to investigate whether and how this leads to an objectivist or relativist approach or otherwise.

Learning from experiences, Dewey (1938) further argues, requires 'inquiry', that is, testing ideas and hypotheses by examining and reflecting upon the consequences which they produce when they are acted upon. It starts from a confrontation with unfamiliar, problematic situations that arouse 'an active quest for information and for production of new ideas' and are as such 'the stimulus to thinking' and the drivers for a continuous spiral of learning as 'new facts and new ideas thus obtained become the ground for further experiences in which new problems are presented' (Ibid., 79). Learning based on inquiry is thus, according to Dewey, closely connected with the experimental method of science. The scientific method requires careful observation and reflective review and, according to Dewey, is unique in its approach of ideas as ideas, as hypotheses instead of as final truths. Treating ideas as truths in themselves would take away any reason for scrupulous examination of them. 'As fixed truths', Dewey (Ibid., 86) argues, 'they must be accepted and that is the end of the matter'. As hypotheses, however, they must be continuously tested and revised, thereby taking into account a wide range of information.

A conceptual framework for analysing ESE practice

Connecting this pragmatist perspective on education to the above elaborated STS concepts allows to construct a conceptual framework for investigations of whether and how ESE practices move beyond the objectivism versus relativism dichotomy. In particular, the work of Jasanoff and Latour will be used to further elaborate how processes of enviroing in ESE practice can contribute to overcoming objectivism versus relativism dualism or otherwise. Transactional educational theory will be deployed in view of translating and applying the STS concepts to the context of teaching and learning.

As illustrated in Figure 2, teaching and learning about ecological and sustainability issues take shape through transactions between people and their environment, i.e. between teachers, students and content. It is through the experienced encounters within this so-called didactic triangle⁸ (e.g. Goodchild and Sriraman 2012) that knowledge (truth) is constructed and meaning made about the issue at stake. This happens by means of inquiry. As argued, this is a dynamic, non-deterministic process in which the specificity of the staged encounters give rise to specific forms of enviroing. That is, the specific transactions between people and the environment affect which aspects of the surrounding conditions become actualised in the participants' experience and which do not. Important to investigate, then, is how the staged encounters – through the specific way of organising the content (subject matter) and process (teaching methods) of education – give rise to a specific sort of inquiry that either enables or hinders to avoid the four above described pitfalls associated with a dualist approach. As argued, the work of Latour and Jasanoff is well-suited to inspire this. With regard to the subject matter, one can examine whether/how environmental and sustainability issues are presented, observed and reflected upon as matters of concern as well as whether/how attention is paid to the STI related to those issues. As to the teaching methods, research can focus on whether/how the staged encounters between students, teachers and content are given shape as what we could call a compositionist and co-productivist inquiry.

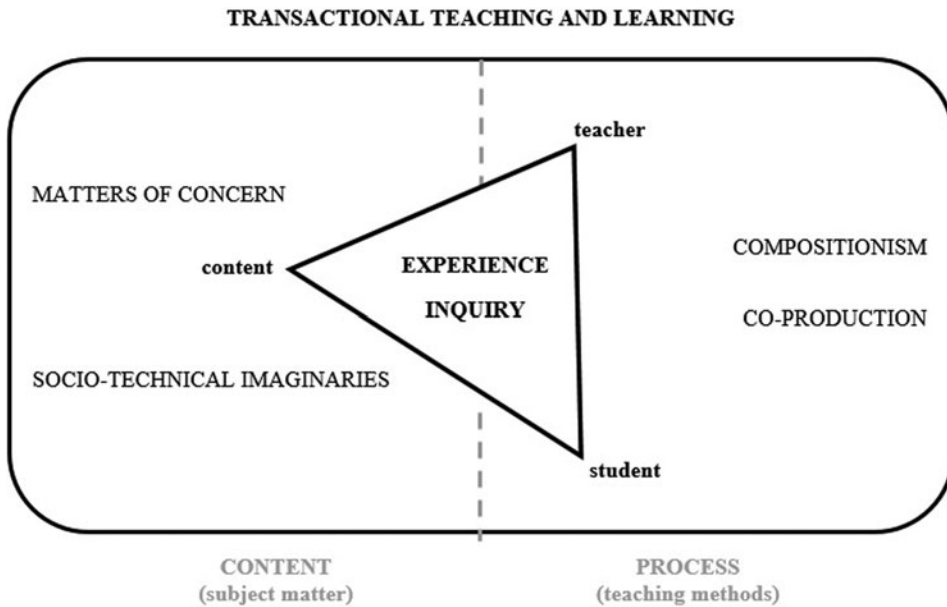


Figure 2. A conceptual framework for investigating other than modern ESE.

Before moving on to how this conceptual framework can inform future research, I will first further explain its different dimensions and try to make it more tangible with some illustrative practical examples.

Examining if the subject matter is presented and approached as a matter of concern, starts from the questions which facts, values, concerns, preferences, knowledge claims, opinions, assertions, interests, commitments, etc. that constitute a sustainability issue are enacted and explored as well as whether/how the entanglement of facts and values is addressed. As I have analysed and described elsewhere (Van Poeck et al. 2016), education practices differ considerably in this respect. One case study showed how documentaries made by educators to initiate in-depth exploration and discussion of sustainability issues such as sustainable fishery, climate change and sustainable forestry can foster inquiry into the inextricable entanglement of a multiplicity of factual knowledge claims, personal preferences, tangible effects of sustainability problems, dreams for the future, scientific insights, ethical considerations, passions, regulations, dependencies, lifestyle practices, etc. The documentaries, as a medium of subject content, but also the way in which the educators dealt with them⁹ made it possible to thoroughly study a sustainability issue through the diversity of those kinds of ‘attachments’ (Marres 2005) involved in it. While making – or, better, ‘composing’ – the documentaries, the educators very consciously made efforts to capture and lay bare this diversity by gathering, connecting and confronting (‘assembling’) as many aspects as possible in an attempt to *add* to the reality of the issues at stake. In the observed discussions that followed the screening of the films, they highlighted the enacted attachments and encouraged the audience to articulate additional concerns, opinions, knowledge, values, etc. As a result, by watching and discussing the documentaries, one can learn how a variety of actors are intimately connected by all kinds of institutional, material, economic, biological, legal, ... ties as well as by being commonly touched, implicated, and mobilised by an issue. The films draw attention to how diverse actors are bound together by irreconcilable claims, interests, values, preferences, etc. What comes to the fore, then, is that in order to take care of an issue, one cannot ignore the effects this has on the other actors caught up in it. Obviously, this way of presenting and approaching sustainability issues as matters of concern differs considerably from the above described examples in which the ecological footprint was presented as a matter of fact or a matter of value.

Investigating the subject matter's attention for STI related to different perspectives on sustainability issues involves analyses of whether/how diverse images of desired futures are addressed and connected to a variety of visions – utopia as well as dystopia – regarding the role of particular technologies and scientific insights in relation to imagined forms of social life and social order. As such, exploring and confronting STI can be considered a very particular way to engage in a Deweyan inquiry, i.e. to test ideas and hypotheses by examining and reflecting upon the future consequences which they would produce if acted upon. In education practice, implicit STI underlying diverse claims and opinions regarding sustainability controversies often remain unaddressed. Again, the two ecological footprint examples show how educators approach this subject content either at the level of proper behaviour (including the proper use of technological artefacts such as a shower or a bath) or at the level of opinions and preferences regarding the desirability of a particular lifestyle, yet without connecting the addressed forms of social life, factual knowledge claims and technologies to imaginaries of different kinds of desired futures. Yet, it may be very interesting from an educational point of view to challenge the students in the religion course, for instance, to articulate and explore diverse STI (e.g. the one that implicitly underlies the documentary of *'Low Impact Man'* as well as their own image of a desired future), to confront this with the consequences of their choice to not limit the ecological impact of their lifestyles within the planetary boundaries and to try to re-imagine alternative configurations of future visions, forms of life and the roles attributed to the technologies that shape our lifestyles.

Researching how teaching methods can facilitate compositionist inquiry has to do with grasping whether and how the employed methods not only invite students to explore how sustainability issues are composed in particular discourses and practices but also to engage in composing, decomposing and/or recomposing sustainability issues *within* education practice. I observed and described an example of that in a case study of a guided tour of a CSA farm (Community Supported Agriculture) for a group of bioscience engineering students in the context of a master course on 'sustainable production systems' (see Van Poeck and Vandenaabeele 2014; Van Poeck and Östman 2017). It was the farmer who guided the tour, starting with an extensive elaboration of why and how he tried to run a sustainable farm. The students made notes. The farmer's interventions – i.e. his way of teaching – repeatedly encouraged the students to react on what he said, even to contradict his opinions and to bring in their own point of view. He grasped opportunities brought about by (sometimes coincidental and unexpected) observations and encounters during the walk on the farm to further explore and discuss the issue of sustainable agriculture. Throughout the activity, more and more students got involved in the discussion, an abundance of concerns, claims, considerations and points of view were raised and the discussion meanders between post-war European agriculture policy, famine, subsidies, pesticides, bio-dynamic farming techniques, shortage of agricultural land, meat production and consumption, GMO technology, phytophthora, distribution chains, consumers' choices, industrial food production, etc. As such, the topic of sustainable farming came to the fore as something that can be – and is – composed in diverse ways. The interaction between students and the farmer also resulted in a continuous de- and re-composition of the issues at stake. For instance, the farmer's composition of unsustainable agriculture as a consequence of European policy was de-composed by students' objections and alternative arguments, re-composing the issue as a matter of farmers' and consumers' choices. Being exposed to a multiplicity of compositions invites the students to take a personal stand (see Van Poeck and Vandenaabeele 2014) and makes them aware of the interests, passions, commitments, values, ideals, concerns, etc. at stake for the diverse actors involved in agriculture, the entanglement of irreconcilable private and public interests, and the need to make decisions about what to care about.

Investigating whether/how teaching methods give rise to co-productivist inquiry, finally, focuses on the question whether and, if so, how encounters between students, teachers and subject content foster awareness about and reflection on how the way in which we (learn to) know the world – i.e. how knowledge is constructed in the classroom – is inextricably connected

to how we choose to live in it. Following Jasanoff, it should be realised that this co-productionist tendency is inherent in any education practice. Östman's (1996) empirical investigations of science textbooks interestingly reveal how the presented knowledge about the world is indeed always entangled with specific views of nature and how to treat it. When, for example, a chemistry textbook contains knowledge on how air can be used to produce raw materials for use in various operations, nature becomes something that can and should be exploited for promoting human beings' material welfare. Thus, the presented knowledge offers students very particular strategies and technologies for reasoning about the world and their place in it while omitting others. As such, the learning of knowledge is always accompanied by the learning of values and the knowledge content of textbooks also functions as socialisation content. It holds the potential to create identities and to affect how students perceive themselves in relation to nature and their fellow human beings, thereby justifying or strengthening certain power relations in society. In education, there is thus always a certain meaning-making in the forefront, while other meanings follow automatically, in the background: companion meanings (Roberts and Östman 1998). Every teaching activity inevitably involves choices about what to include and what is left out but this often remains implicit. In their way of teaching and dealing with such inclusions and exclusions, teachers largely affect the room for creating awareness and reflection on the co-production of our knowledge about the world and our preferences regarding how to live in it. One can teach, for instance, about the ecological footprint with exclusive attention for scientific facts and calculations about the ecological impact of certain behaviour, thereby offering very particular companion meanings that serve as socialisation content for how to live in the world as an ecological citizen. In doing so, a teacher can ignore all alternative considerations or perspectives raised by the students or re-frame them into the logic of indisputable matters of fact (for an example, see Van Poeck and Östman 2017). Inversely, the religion teacher in the example above organised a classroom discussion in which she did not encourage the students to connect their idea about how they want to live in the world with knowledge about the ecological implication of their choice. The aforementioned CSA farmer, on the other hand, repeatedly connected knowledge claims made and arguments used to diverse views on the kind of agricultural system we want and also very explicitly related his own arguments and opinions to how he wants to 'change the world' and 'do something useful' (Van Poeck and Vandenabeele 2014, 229) by engaging in a form of agriculture that 'puts the planet first'. Explicitly exploring the connections between our knowledge of the world and the way in which we want to live in it – alternating between what is fore-fronted and backgrounded – can foster an inquiry into the co-production of knowledge and values. Thus, neither scientific facts (e.g. on the ecological footprint) nor personal preferences are presented as the only possible way to approach an issue.

From a conceptual framework to empirical analyses

The examples described above are merely meant to illustrate the key dimensions of the conceptual framework. Obviously, applying this framework to concrete empirical case studies requires a much more in-depth analysis and demands further operationalisation in line with a specific research focus and questions. Such research is much-needed in order to progress the debate on ESE in a post-truth era by nourishing it with thorough empirical underpinning that can move the discussion beyond the level of general principles. Vital questions that need to be addressed in case studies are, for instance: How do/can the staged encounters between teachers, students and content...

- affect how truth is approached in ESE practice? Is it approached as absolute or temporary? Is attention paid to how truth is constructed? Do teachers and students address questions of

logical truth and/or topical truth? Which questions/concerns arise in discussions over topical truth?

- enable 'pluralistic' ESE (see introduction) in a way that avoids the danger of relativism? Under which conditions?
- encourage students to be critical? Does criticism take the form of debunking (deconstructing) or of assembling? How does this affect the meaning-making about the issue under study?
- open-up possibilities for new ways of seeing and reasoning? Under which conditions?

Beyond the above presented theoretical model, addressing such questions demands a sophisticated analytical lens that allows to operationalise the conceptual framework for empirical investigations. Important thereby is that the practical perspective on epistemology and education that underpins the framework requires operationalisation through equally practical analytical methods. Luckily, we do not have to start from scratch for this analytical work. Educational researchers have already developed didactical analytical methods inspired by Dewey's pragmatic, transactional perspective (Östman and Öhman 2010, Östman 2010) and applied them for empirical studies in science education and ESE, e.g.: Practical Epistemology Analysis (Wickman and Östman 2002) enables a 'high-resolution' analysis (Östman 2010, 83) of how meaning is created in educational practice, Epistemological Move Analysis (Lidar et al. 2006) and Political Move Analysis (Van Poeck and Östman 2017) allow to investigate the impact of teachers' interventions on students' learning, Transactional Argumentation Analysis (Rudsberg et al. 2013) facilitates investigations of how people learn from deliberative discussions, etc. In combination with the presented conceptual framework, these have great potential to inspire sophisticated empirical investigations of how ESE practices can avoid the pitfalls involved in an objectivist as well as a relativist approach.

Discussion and conclusion

As mentioned, the aim of this article is to progress theoretical and empirical research on how ESE practices can move beyond the objectivism versus relativism dichotomy. By developing and presenting a conceptual framework for such investigations, my hope is that a growing body of varied case studies can contribute to a deeper and empirically grounded understanding of this topic. Taking into consideration Latour's important appeal to move away from the irrelevant discussions about whether something is constructed or not, toward the crucial question whether it is *well* or *badly* constructed, an important challenge for ESE research is to gain insight in the conditions and criteria that constitute 'good' and 'bad' constructions in the specific context of educational settings. Such research is much-needed in the context of the current post-truth debate if we want to acknowledge and embrace the constructedness of facts, knowledge and truth without falling into approaches 'in which bullshit is highly valued' (Sismondo 2017, 3).

As argued above, this article's contribution should be understood as an attempt to inspire and facilitate such research. I have shed some light on its potential to do so in the previous paragraph. Now I will conclude with pointing out two important limitations of the presented framework, i.e. two potential pitfalls one needs to bear in mind while using it. First, as Öhman and Östman (2007, 53) argue, 'in striving to avoid dualism it is tempting to replace it with a universal claim for holism, and in this way exchange one metaphysical standpoint for another'. The anti-dualist perspective that fosters the search for an approach to ESE beyond objectivism versus relativism should thus not be understood as universal category, as a utopian, 'new', and thus fixed or static 'position'. As argued elsewhere (Van Poeck et al. 2016) that what Latour (2004a) labels a 'fair position' dealing with matters of concern cannot be understood as a particular, well-defined position in the sense of a point of view from which one approaches reality the 'right' way. Rather, it is a time and space where, on the contrary, a multiplicity of standpoints

can be explored while switching perspective from one to another. 'The great thing about a standpoint', Latour (2004b, 65) argues, 'is, precisely, that you can change it!'. This is in line with Östman and Öhman's (2010) argument that the problem with a dualistic approach is not so much *that* it makes distinctions but rather that the distinctions are *preconceived*. Hence, the presented framework should only be used as an *analytical* tool, never as a prescriptive or assessment framework for an anti-dualist approach 'beyond objectivism and relativism' as an educational ideal. And in using it for research on educational practices, it is vital to remain faithful to the pragmatic logic underlying its construction in view of specific purposes. This is aptly described by Dewey and Bentley (1949): 'Our assertion is the right to see in union what it becomes important to see in union; together with the right to see in separation what it is important to see in separation' (quoted in Ryan 2011, 40). It is thus not 'the' tool but 'a' tool (Ibid., 40) useful for specific research purposes and questions. This brings us to a second, related, limitation, i.e. that the conceptual framework should not be conflated with a *theory* of non-dualist teaching and learning about environmental and sustainability issues. The developed theoretical model is an analytical framework with the ambition to foster further inquiry, not at all to stop the need for such inquiry by providing general and universal explanations of phenomena, events and practices (Östman and Öhman 2010). With their transactional perspective, Dewey and Bentley never aimed at introducing a new universal theory or ontology, yet at presenting a method of inquiry, of investigation. Analogously, this paper presented an analytical framework hoping that the findings emerging from its application in a variety of analyses may eventually contribute to an empirically grounded theoretical knowledge base.

Notes

1. This, obviously, affects the matters of fact that are created and scientists involved in the practice of measuring and calculating footprints also recognise the limitations of their activities. Damaging environmental consequences of how we use the land (e.g. soil erosion and the overuse of water reserves), for instance, simply cannot be assessed since that would require data sets that do not exist (Pearce 2013).
2. See Van Poeck & Östman (2017) for an empirical example in a case study of an ecological footprint workshop: The participants reflected and deliberated on how to deal with different, conflicting concerns such as factual knowledge about ecological benefits of reducing car traffic, concerns about a lack of time, the safety of their young children if they travel by bicycle, etc. In this conversation, both facts and values were raised and acknowledged as legitimate elements in making a decision.
3. 'Cars as we know them', for instance, 'would never have taken to the roads without the myriad social roles, institutions, and practices spawned by modernity: scientists, engineers, and designers; patents and trademarks; autoworkers and big corporations; regulators; dealers and distributors; advertising companies; and users, from commuters to racers, who ultimately gave cars their utility, appeal, and meaning.' (Jasanoff 2015).
4. Jasanoff refers to examples such as all-male orchestras and all-black passengers on the backseats of busses.
5. Analysing and discussing the development of nuclear energy in USA and South-Korea, for instance, Jasanoff and Kim (2015) have used the concept of STI to show how institutionally stabilised imaginaries *shape* subsequent developments rather than that they open-up possibilities.
6. I use the term 'didactics' here in line with the Continental, Northern European tradition in which the term ('Didaktik') is closely related to the reflexive pedagogic idea of 'Bildung' and thus differs considerably from the more narrow and instrumental use of it in Anglo-Saxon contexts focusing on methods, instruction and learning outcomes.
7. Some scholars have actually explicitly situated Latour's work within the pragmatist tradition (e.g. Dijkstra 2007).
8. In its simplest form, the didactical triangle is a heuristic focusing on the three fundamental components of teaching and learning practices: teacher, student and content. It serves for analysing didactic systems with a focus on the relations between these components. Extended models of the didactic triangle have been created in view of more sophisticated analyses that also take into account, for instance, the societal context beyond the classroom (Hudson and Meyer 2011). For reasons of clarity, however, I use the basic heuristic in this conceptual framework.
9. See Figure 2: As the dotted line between 'content' and 'process' indicates, it is impossible to sharply separate (the effect of) subject matter and teaching methods in education practices. As such, the division between both in the framework should be understood as an *analytical* distinction. In line with the transactional

educational theory underpinning the model, it is important to realise that content and process continuously and reciprocally affect one another through the staged encounters between subject content, students and teachers. Hence the didactic triangle overlapping the content and process sphere in the figure.

Acknowledgments

I owe great thanks to the three anonymous reviewers of this article as well as to Gert Goeminne, Leif Östman, Jim Garrison and Maarten Deleye for their valuable feedback and inspiring comments on earlier versions of this paper.

Declaration of Conflicting Interests

The Author declares that there is no conflict of interest.

Funding

This research received no specific grant from any funding agency in the public, commercial, or not-for-profit sectors.

Notes on contributor

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